 ORIGINAL

REMEDIAL PROJECT MANAGERS' MEETING

NASA/JET PROPULSION LABORATORY

25 March 1999

ATTENDEES:

Charles L. Buril, JPL
Alex Carlos, RWQCB-LA
Mark Cutler, Foster Wheeler
Michelle Colbert, Multimedia Environmental Technology, Inc.
Richard Gebert, DTSC
Mark Losi, Foster Wheeler
Perry Montazer, Multimedia Environmental Technology, Inc.
Stephen Niou, URS
Judith A. Novelly, JPL
B. G. Randolph, Foster Wheeler
Mark Ripperda, USA EPA
Peter Robles, Jr., NASA

Reported by: Louise K. Mizota, CSR 2818

Pasadena, California

March 25, 1999

9:18 A.M.

ROBLES: Shall we introduce ourselves?

BURIL: Yes. Let's go ahead and do that.

Go ahead and go around the table here for Louise's benefit.

Judy, why don't you start.

NOVELLY: Judy Novelly, JPL.

BURIL: Chuck Buril, JPL.

ROBLES: Peter Robles, NASA.

CUTLER: Mark Cutler, Foster Wheeler.

LOSI: Mark Losi, Foster Wheeler.

RANDOLPH: B.G. Randolph, Foster Wheeler.

GEBERT: Richard Gebert of DTSC.

RIPPERDA: Mark Ripperda from U.S. EPA.

MONTAZER: Perry Montazer, MET.

BURIL: Perry is the person who has worked most diligently on the development of the groundwater model for our use here at JPL. And since we're in a position of using this thing now as part of the feasibility study, I thought it would be a good idea, as we discussed in previous meetings, to have him come in and show us the model, describe it to us and

give us a little background and some information about how it's been used so far.

So, Perry, why don't you go ahead and kick it in gear.

MONTAZER: Good morning, everyone.

There's Michelle.

(Ms. Colbert and Mr. Carlos entered the meeting room.)

BURIL: Alex. All right.

MONTAZER: Good timing.

BURIL: We were just literally going to start and then just catch you up. So you walked in just in the nick of time. That's great.

Perry, is this your assistant here?

MONTAZER: Yes. Michelle. Michelle Colbert.

BURIL: Okay.

MONTAZER: Michelle has done a great deal of data preparation and processing and she's done some of the simulations and --

BURIL: Okay. Great.

MONTAZER: Okay. This project goes almost three years, two and a half years we started working on the JPL groundwater model.

The main purpose was to set up a model that we could look at the groundwater variations and

a tool so that you can -- could be used in the RI and the FS, eventually try to look at different scenarios as to what might be happening when you implement certain remediation schemes.

The model first was set up in a two-dimensional way. We set up a 2-D model of the basin first. Actually, we developed a report for it. Unfortunately, we early on realized that two dimensions was not, as I'll go through some detail a little bit, 2-D was not appropriate for the basin.

I'm going to be going through a little bit of the two-dimensional model approach briefly and give you a more expanded version of the three-dimensional model, why we went to 3-D, and the conceptual model of the area, how we came up with the conceptual model, and availability of the data supporting that conceptual model, and go through the grid set-up and discretization in time and then calibration and model and some of the difficulties that we were faced with in the calibration and we still are faced with in calibration. I'll try to summarize and come up with general conclusions and remarks.

I wonder if we have a pointer here.

The Raymond Basin, this is kind of a 3-D

topographic, aerial photograph is overlaid on the topographic pattern in the basin. We have the JPL facility here. These figures are more clear on your handouts. There are these handouts that --

Mark, do you want to distribute those handouts?

BURIL: Does everybody have a copy?

MONTAZER: Everybody has a copy? Okay.

We are basically -- we have the boundary of the San Gabriel Mountain in the north with the crystalline rock more or less as an impermeable boundary. Permeabilities are too low for us to be concerned with. And also, we have these hills to the south that are exposed crystalline rocks that form the boundary. And basically, a basin filled with alluvial material.

And we have -- as you can see, this is pretty well-developed area. That's one of the key problems in the development of the -- trying to figure out how the recharge works in the area.

This just gives you the general view boundary of the -- this is JPL. And this is -- this whole thing is the Raymond Basin boundary, which is the model that was used by CH2M Hill prior to this project. The unfortunate thing was that in this

area, especially in the JPL, the CH2M Hill model was not detailed enough to be of any use.

So Foster Wheeler began this area with a more refined mesh and two-dimensional configuration. And I'll show you a little bit as to where we go -- where the mesh, et cetera, later on.

RIPPERDA: Was CH2M Hill working for the Raymond Basin or City of Pasadena?

BURIL: It was with the Raymond Basin, actually, and through the City of Pasadena. And with Raymond Basin we had a cooperative agreement that they would supply the data for us.

MONTAZER: The boundary of the model area, this is this yellow line, basically shows the modeled area. And these red lines are where the, basically, no-flow boundaries are set. Even though the grid exists past these red lines, they're inactive and don't -- do not -- no flow occurs over there.

The Devil's Gate Dam, some of the features I want to point out, the reservoir, it's more or less sand and gravel. There is the Arroyo Seco spreading ground, which receives recharge various time of year when rainfall occurs.

We have several -- basically, three well fields that pump. And their scheduling varies from

time to time. The Pasadena wells are the most active ones. And I'll show you a little bit as to --

BURIL: I wonder if I could, just for a moment, kind of orient people.

MONTAZER: Sure.

BURIL: These wells up here are Valley Water Service Company, Foothill Water, places like that.

The four along here, these four, those are the City of Pasadena wells. The Windsor reservoir is located at this site. Then Ventura, 52, and Arroyo.

And then these other two out here are Lincoln Avenue wells, Wells 3 and 5.

Then down in this area is Rubio Canyon and Las Flores. I don't recall the distinction between which ones are which. But those are the water companies that own the wells, to kind of give you some orientation as to where they are.

Go ahead, Perry.

MONTAZER: Sure. Okay.

First, the two-dimensional model that was set up was discretized basically by 100 by 100 grid in it. It had only one layer in it. It encompassed the entire thickness. It had variable thickness

based on the bottom of the aquifer in this area. There is data from CH2M Hill and they have some GIS information and the wells that were drilled at the time. They were -- I think at that time we had about 17, 18 wells that we used to get the bottom of the aquifer defined. Bottom of the aquifer was considered to be the crystalline rocks.

We went through a calibration exercise of the two dimensions. We realized that it was -- it was relatively easy to calibrate outside of the JPL, but in this area we could not get two-dimensional -- the 2-D representatives did not give us the flexibility to be able to accurately calibrate. And I'll -- you can see this when we get to some of the well fluctuation.

I'll show you some of the pumping rates, the schedules. In the two-dimensional case we used about a 16-month period for the calibration. There's about three years of data available. At least at the time that we did the modeling was about three, three and a half years of data was available.

You can see the pumping rig. Pumping really starts going off during March and continues, continues through December.

BURIL: You might give them an indication of

what the individual curves are.

MONTAZER: Oh, okay. These are well numbers. This is La Canada number 1.

BURIL: Lincoln Avenue?

MONTAZER: Yes. Lincoln Avenue, the red one. The square is Lincoln Avenue. This is Lincoln Avenue number 5. The yellow one is -- it starts, I guess, towards the summertime. In this particular period it wasn't pumping.

The Valley well number 1, 2, 3 are this one. Valley well number 1. The asterisked one is number 2. And number 3 is -- looks like it just pumps during the summertime. It's not pumping here. And Valley number 4 pumps a little bit here and pumps during the next year's summertime.

BURIL: Just a little brief indication of why you see this variation. Basically, the water companies here are also tied into Metropolitan Water. During the winter it's actually more cost effective for them to purchase their water from Met than it is to pump it out of the ground. So they are spreading and storing water in the aquifer as best they can during the winter months, and Met will give them a break on the water since they have a glut of it available during the winter. And then

during the summer they rely on their own water supplies.

Somehow, in a mechanism I'm still not completely sure I understand, Met will give them a break on the rates if they pump certain amounts out of the aquifer rather than buy it from Met. So they, I think, can get it cheaper. That's one of the reasons why the water companies are very concerned about how much water they can actually get out of the ground at any given time through the adjudication. That break from Metropolitan is actually fairly substantial, I guess.

CUTLER: I think one of the points in this, too, Perry will probably give it to you later, is it's hard to calibrate such a dynamic aquifer when you have so many different pumping schedules and different rates and no two years are the same. It's created a real problem.

BURIL: Go ahead.

MONTAZER: These are basically the Valley wells on the west side, as Chuck pointed out. These are on the east side.

Then we have the Pasadena wells, which are the most active. They pump the largest amount of water. These are the four wells that were right in

the center of the area. And they almost pump continuously. There are a couple of -- I'm sorry. Is there a comment?

BURIL: No.

MONTAZER: There's a period of time like in February or so that they shut down. I don't know, is that for maintenance or --

CUTLER: Yeah.

MONTAZER: Which we have used these periods where the aquifer recovers. And we've used them to set up our initial conditions, et cetera. Otherwise, the aquifer, the whole system is very dynamic, as Mark mentioned. It's complicated.

This is just for the August '95 through November '96 precip. This is from the Pasadena City Hall meteorological station. As you can see, when we get the recharge - I want to overlay these - for the same period of time, this is what is really put into the spreading grounds.

(Mr. Niou entered the meeting room.)

MONTAZER: And what we have found out that it's not necessarily what reaches the groundwater, but it very much coincides with a slight lag of about a month or so for the precip. As the precip goes up, you know, the ponds get filled up and more recharge

is -- I think these are gauged as they go into the ponds. They don't necessarily mean that they percolate water. There's evaporation involved. There's runoff. There may be leakage, et cetera.

So this cross-section -- I don't have an overhead transparency of this.

Mark, do you want to have those copies of --

CUTLER: I don't know if we have enough for everybody.

MONTAZER: Just the second page, so we can look at it.

One of the things that we have to consider -- now, in the three-dimensional model we discretized in a vertical direction the aquifer, the whole system, into six different layers.

Now, the layers in the model really are not necessarily the layers in the aquifer. It's just as is in the horizontal, the discretization, the node spacing has nothing, really, to do with the material. Vertically doesn't -- doesn't have anything to do with the material either.

But based on the geology and the variation in the pumping and et cetera, Foster Wheeler came up with three different layers. And it is kind of

evident, and we more or less discovered this during the modeling process when we were doing the calibration, that when you look at some of the wells, some of the monitoring wells that are internal, and I'll show you some of those graphs, there is more separation. There are five --

Is everybody familiar with the installation of those wells, how those monitoring wells are set up?

CUTLER: I think so. West Bay Wells, the five ports.

MONTAZER: Yeah. Basically, each one of the monitoring wells has five ports. And there are a couple of the wells that are outside the area that -- basically, I think 14 and 21. And they're not on this graph. They're in one of -- I'll show you the graphs. Because there's really no difference in the hydraulic -- in the head, in the piezometric level between the top and bottom, bottom piezometer, meaning that whatever is happening up on the top is instantly sensed by the bottom layer. There's not much hydraulic discontinuity between the two.

But as we go towards the Arroyo Seco, the separation becomes more pronounced. And based on

the model and the geologic -- study of the geologic columns and et cetera, basically we came up with three different layers. These layers are not continuous. That is, the confining -- there are two distinct confining layers that are in the vicinity of the Arroyo Seco, and their extent actually is different at different depth. I mean, the upper confining layer is more extensive than the -- or is it vice versa, the bottom than the lower confining layer.

The thing that I want to show on this cross-section is the way the screens -- if you look at the Arroyo well screen, the well, it is screened wherever they felt that was useful for the productive zone. And when they put -- they put a pump, there's only one pump, and it produces from all these different screen intervals. In some of the wells, the entire thickness of the aquifer is screened and is being pumped.

The amount of pumping that comes from each one of these individual layers, the model layers or the aquifers, is unknown. We know the total, but we don't know how much water is coming from each one of these sections. That was one of the most difficult part of the calibration in 3-D because we had to go

and adjust the pumping rates between the three different -- in the different aquifers to match the observed piezometric head something.

Another problem was the recharge. As I mentioned that recharge, we don't have a good idea as to what happens, what happens to the rain, where the water recharges. And actually we discovered during the calibration that there was an unknown recharge area. There was a golf course up on the northwest part of the site. They've got a lake in it. And during the modeling we realized there's got to be some recharge going on up in that area, which it's not part of the groundwater system, but it's there. The model sensed it.

NIOU: How far is it?

MONTAZER: I'm sorry?

NIOU: How far is it from the site?

MONTAZER: Let me show you on the aerial photographic. I believe it's in this area. I don't know the exact location. It's somewhere up in the hill. There's a golf course with a lake in there. I mean there's a pond there.

Do you know, Mark, exactly or more closely where that golf course is?

CUTLER: It's up in La Canada somewhere. I

think it's farther.

MONTAZER: Farther up in here?

CUTLER: Yeah. It's way up to the west.

MONTAZER: Right. I think that's -- yeah, that is true because that's where we had to put some of the recharge nodes up there.

Now, of course, the other problem is not knowing the extent of these confining layers. Even though they may be in a lot of places, you may -- we may see the presence of a fine layer, but it's not necessarily producing a separation between the piezometers. It's either discontinuous or it's not as effective as some of the more continuous layers in the system. So that's another difficulty that we had, to go and calibrate the vertical conductivity of these aquitards to adjust the pumping rates.

NIOU: I'm late, but may I ask, what's the normal ratio of vertical conductivity versus horizontal?

MONTAZER: I'm sorry. It's variable. It varies all over. The calibration from cell to cell, it changes.

NIOU: How do you get the different vertical conductivity?

MONTAZER: It's all calibrated. It's all

calibrated. We start with some initial guesses, but when the calibration is done, all the values are set. We don't pre -- we don't priorly assume what's the hydraulic conductivity or horizontal versus vertical. One thing that we assume is that in the horizontal direction we don't have an isotropy, which is actually not the case -- in some areas we've had to incorporate some isotropic conditions to calibrate. And I'll show you those results.

But in general, in the horizontal direction, the permeability is -- the hydraulic conductivity is the same in both north and east, but in the vertical direction it varies. It varies. It changes from orders of magnitude. Five, six orders of magnitude it changes.

(Mr. Buril left the meeting room.)

NIOU: Across all three layer, or within one layer?

MONTAZER: Between the layers.

NIOU: Between layers.

MONTAZER: Between the layers. Right.

NIOU: That makes sense.

MONTAZER: Between the layers it changes.

NIOU: Okay. Did you use steady state, or did you use transient state?

MONTAZER: No. It has to be transient to be able to simulate over that time. Initial -- initially it was -- to get the initial conditions we did some steady state simulations. But then we had to do the transient simulation over the 16 periods to simulate, to be able to calibrate.

NIOU: Simulate pumping of the city water?

MONTAZER: Yeah. All the pumping wells, all those pumping wells that I showed, those variations are all incorporated for every month.

NIOU: Okay.

MONTAZER: For every month we have -- we changed the pumping rates. The recharge changes. And all of that is being balanced by how much we see in the piezometric -- in the piezometers, in the monitoring wells. And we calibrate that. Very, very difficult process.

First we attempted doing manual calibration, which is basically going and making runs and looking at the results. And it was -- we saw that it was a difficult process, then. So we decided to do -- to use Mod Flow P.

(Mr. Buril entered the meeting room.)

MONTAZER: And we found out that Mod Flow P would not work. Actually it was only good for

steady state and when we got into transient there were a lot of bugs in it. And we pointed out those things back to the authors, U.S. Geological Survey, and they've never gotten back to us.

We spent a great deal of time trying to use Mod Flow P to automatically calibrate this. And it wasn't successful. So in first run, and actually the report that we generated we -- that is -- I think that report is distributed. Who has that report, that modeling report?

CUTLER: JPL.

MONTAZER: JPL has it. First report we did, it was manual calibration. Then we attempted to do Mod Flow P. And then we got -- we tried genetic algorithm. Neither one of them -- genetic algorithm worked. There was no bug in it, but it could not -- we let it run 2-, 3,000 runs and it could not convert to a solution.

So we went back to the drawing board. But we used a little bit of what we learned from the genetic algorithm to manually calibrate it. We set up a kind of an automated system to generate the results quickly, relatively quickly, and so we could go through the calibration process.

NIOU: Did you do any -- like a hybrid

recreation thing to help you to know what's the optimal match? Did you do that?

MONTAZER: Oh, yeah. After -- we have done a lot of -- the problem is it's -- even with some of the calibrations, early on calibrations that Mark didn't like, we came up with very good regressions. So that regression doesn't mean anything. The regression coefficient .9, I think we reported it in that report, regression coefficient. But there are some wells that are 90 feet off and Mark didn't like those, so we had to go back to the drawing board.

CUTLER: Perry had it, after days, weeks and months, just hours and hours, a couple wells were very far off, very critical screens, you know, where Wells 17 and 18 are just off site where on-site contaminants seemed to be heading. Those two wells in the second layer, our RI layer, were the screens that were the problem.

And that's the area where all the action's going on. That's the area where we want to try to show through various pumping scenarios with the city wells that that area is, indeed, being remediated through pumping of the city wells. So I said, "Perry, we got to do something about it. I don't care if Well 20 is off. That's two miles down the

road. But we really need to get these wells a closer match." So that's what he's talking about.

So Perry had to kind of mess up some of his other wells to make these match because this is where I think it's important to you guys and to us to show that things are accurately modeled.

NIOU: Did you do weighted regression like for each place, like 17 and 18, weight it so that you optimize not according to each number same way, but weight some of the numbers?

CUTLER: I don't know. Did that happen?

MONTAZER: No. We just did a straight, standard regression.

NIOU: A straightforward regression. Okay.

MONTAZER: The piezometer versus simulated. Results came out pretty good. But the thing is if the trend is -- if you can simulate the trend, the regression is good. The absolute values may not be good. But if the trend is simulated, the results come out good.

The weighted regression may have helped a little bit. But the best way to -- this I don't think there's any -- a good way of really judging this but an expert eye judgment. And also when I go through the response, there are 50 observation

points, 50 -- there's 21 wells. Each one has got five, five screens. So there's 102.

CUTLER: Not all multi-port. I think it's more like 60.

MONTAZER: Yeah. Yeah. Right. I'm sorry.

CUTLER: At that point we had 60.

MONTAZER: Right. That's right. I had 52. We had 52.

CUTLER: Not counting the production wells.

MONTAZER: The monitoring wells. The piezometric had measurements. There are about 52 points.

CUTLER: We had a lot of water levels to try to match. It's such a dynamic system with so many amounts.

MONTAZER: The only way we could really go to -- go through those graphs. And I'll show you on those graphs -- I just wanted to -- I just wanted to point out the -- now, even though with, you know, the expert judgment, gut feeling, we feel that this is unique, because you can't touch it. You touch that, something else changes. So we're getting pretty close to that unique solution. But it's still uncertain. It's really -- because the recharge is unknown and the distribution of the pumping in the

wells are adjusted, even though we have a total flow rate. But between different -- how they are divvied up between different --

CUTLER: That's something we'll never know.

BURIL: Why don't you show us on the --

CUTLER: You have pumping screens against all three layers. We'll never know which layer produces more water than the other layer. We will never know. And we have so many -- there's so many production wells out there at different rates, no one will ever know that.

That's a critical part. So you've just got to make your estimates and see how it turns out.

BURIL: This is the best guess that we can come up with.

CUTLER: Right. There's no way you'll ever know.

MONTAZER: In this figure, these dotted lines are the simulated results. The continuous curve is the water level.

CUTLER: Actual measurement --

MONTAZER: Actual measurement.

CUTLER: -- versus simulated.

MONTAZER: Right. These are all the shallow wells. The top aquifer, the top aquifer, which is

unconfined. These trends represent those.

Our assumption was that the top aquifer, which is unconfined, received the recharge. And, therefore, once we did -- we went through the first go-around, we had to go back and adjust the recharge, adjust these trends. Once you adjust the recharge up in here, the lower piezometers change. So you have to go back and work your way back up and then go back and change the recharge and then go down again and work your way back up between the three layers.

So it's just -- you have to do this continuously until you come up with the best results.

Therefore, recharge itself is calibrated. The recharge itself is calibrated. It's not a known value. It's a calibrated value. The hydraulic conductivity, hydraulic parameters are calibrated value and storage coefficients, et cetera, are calibrated, and so is the geology, in a sense.

This area, I just have to mention that this is the best distribution of data I've seen anywhere in an aquifer in a model. Mark has done a great job of getting this data. This has been the problem. I've never been in a project that I've had

so much difficulty calibrating a model, because usually we don't have enough data and it's easy to calibrate. But here there's so much data --

BURIL: So our abundance of data has worked against us.

MONTAZER: It has, but you've got a better model. I can tell you that this is probably the best calibration I've done in any other project because of the availability of data we have.

BURIL: What's the model tell us?

MONTAZER: There's always uncertainty.

Okay. Now, one thing I want to make note is that there are these -- there are three, four wells up in here that we have -- the response is pretty flat. You know, all of these responses are to the pumping, these shallow wells, except those three wells. MW-1, 5 and -- I mean 15 and 9, they don't respond. So we concluded that there's got to be some sort of separation out in here and that we had to impose that. And their levels are much higher, about 100 feet or so higher than the rest of the aquifer.

CUTLER: They're up on that groundwater mound.

MONTAZER: Yeah. There's some form of mounding occurs when the Arroyo Seco flows into the -- right

into the -- right into the boundary of the spreading ground, there has to be something to keep -- keeping these -- the water level in those shallow wells up that high.

BURIL: I think it's important to note, too, that typically those three wells show nondetects. They do not have contaminant concentrations.

CUTLER: Exactly. They're not critical for our purposes.

BURIL: Right.

MONTAZER: The next graph shows the calibration of the deeper wells. It's better than we've ever had it before. Our worst case is down in here.

NIOU: Is this your lowest layer? The third one, or the second one?

MONTAZER: This is layer 1, layer 2, layer 3. These top -- I'm sorry.

CUTLER: Let me just explain to them what we did. With each of these multi-port wells we had five screens, as you know.

NIOU: Yeah.

CUTLER: It was getting to be mission impossible to match water levels with all five screens at once.

NIOU: Yes.

CUTLER: So the RI report was based on basically

three aquifer layers below the site. The fourth layer is out by Well 21. So to be able to use our contaminant contour maps and our aquifer and piezometric surface maps, we would pick the same three screens that defined those maps, we would try to calibrate to. So as Perry goes on, when he would print out like a layer 2 map, he would be using the same piezometers, the same screens that we would use to generate a layer 2 contaminant contour map or a layer 2 piezometric surface map. So everything is equal. So that's why you see basically three screens there, is typically the top line is the upper screen, second line is the second screen, third line is the bottom screen.

NIOU: Okay.

CUTLER: Or the bottom layer. I'm sorry.

MONTAZER: Basically, the reasoning for that, if you look at some of these hydrographs, is that there are three distinct separations. You know, usually two of the screens, the piezometric head is pretty close. They're within a few feet from each other. And the top two are pretty close to each other. That's why Mark decided -- we were trying to do five-layer calibration or six-layer, actually, calibration. Mark decided that based on the geology

and based on these separation, we just go -- divide the aquifer into three layers. The model still has six layers in there. We just have removed the separation between -- on the vertical conductivity they represent just three layers. There are two layers that basically behave as the same aquifer.

NIOU: So here you're matching all of them, all three. Right?

BURIL: Yes.

MONTAZER: Matching all three. This top one is a shallow aquifer, which was the previous figure. But these are only the deep wells that -- I mean that have five piezometers in them. The previous graph was everything that they had that -- we used the top layer to calibrate, but basically give us a good distribution of the recharge calibration. We have a good distribution of wells so we could do the recharge calibration. And then we had to go to depth and calibrate these bigger ones.

One thing you notice on MW-21, all five piezometers have exact the same, and so does MW-14. And if you notice, they are out in this area. What this says is that somewhere over here and beyond, the aquifer is uniform from top to bottom. There's no separation. There's no aquitard separating the

entire -- we have, what, 6-, 700 feet of alluvium. It's all more or less uniform. But as you go more towards the Arroyo Seco, the separation increases, gets more and basically looks like there has been some depositional process associated with the Arroyo Seco, some mud flow or something coming in that's depositing fine layers, fine-grain deposits every so often and that has created these three aquifers that are generally in this area, at least as far as the data shows.

BURIL: Why don't we press on, Perry.

MONTAZER: Okay. All right. I guess that basically is the calibrated model.

Now, I just have to show you some of the -- first, I show you the general distribution piezometric graph that Michelle has worked on. For the stress period -- the stress periods basically are the times -- this is for September 1 and this shows the general piezometric head distribution. You have the flow of water coming down in here from there and actually the aquifer down to here, and also we have some recharge on the northeastern side that flows towards the south and the southeast -- southwest.

NIOU: What does the color mean?

MONTAZER: The color?

NIOU: Yeah.

MONTAZER: It's changes in the head. That's just -- they're colored to show the changes. They're not necessarily -- you know, the higher level -- we don't have a color bar?

BURIL: There's not a color bar on this one.

MONTAZER: Not on this one. This shows the entire -- what he have done -- let me show the blowups that are more -- basically, the blue means about 1,000 feet. If you have any purple, it's 900 feet. And --

NIOU: So it's just elevation differences?

BURIL: Yes. That's all.

MONTAZER: Yes. Piezometric head.

NIOU: Okay. There is a dark point here. What's that?

MONTAZER: I'm sorry?

NIOU: There is a dark point here.

MONTAZER: There's a protrusion of bedrock.

NIOU: Oh, bedrock.

MONTAZER: Yeah. The bedrock comes up, yeah, in that area.

NIOU: Where is this at?

MONTAZER: Where is it at?

NIOU: Yeah.

BURIL: You're looking at a very large scale map there, Stephen. We've narrowed it considerably on this one.

RANDOLPH: Go to the next page. Go to the next page.

MONTAZER: This area that we're showing -- basically, I guess you could get it from the -- this is not the entire modeled area. This is just the one that -- the JPL area. This is the JPL boundary.

NIOU: So this is a large --

BURIL: Very large scale.

NIOU: It's large scale.

CUTLER: It's Raymond basin.

BURIL: It's the Raymond Basin.

NIOU: Okay.

MONTAZER: The whole modeled area, the rectangular area that I showed. And then we just focused on the area of the JPL because that's the area of concern, to show how -- you see this mounding is -- this is what we're talking about that is shown by that. And this actually -- in the water level contour maps also you have this -- you show this mounding.

Basically, this is the top layer for

September.

I'm just going to go through these quickly. We have some animations of these made on the computer.

This is for layer 2. The mounding on the top is not as distinct.

Layer 3. This is what I was talking about as far as -- we've had to -- the change in the hydraulic -- the piezometric head, there's a steep gradient there. This is because we've had to put a barrier in there, separate out those two -- those wells. And I don't know the nature of it. Could be a fault zone. It could be just a depositional change.

And that same feature also creates these mounds. This is in December. Water levels are --

BURIL: Perry, if you could, just because it looks kind of interesting, these tooth-like structures here, what are those?

MONTAZER: Okay. Those are artifacts of the Kriging. You can't get rid of them. Let me tell you -- let me explain why. When we run the model, we have to -- these are inactive cells right down in here. We have to assign a value to them. And we assign them a value minus 2,000. They're

meaningless as far as model run.

NIOU: Sink? You mean sink?

MONTAZER: I'm sorry?

NIOU: Sink?

MONTAZER: No, no. They're just meaningless. They're just a number.

CUTLER: It's just bedrock.

MONTAZER: It's bedrock. It's meaningless. When we come and do the Kriging it creates a steep gradient between 1,000 feet to minus 2,000 feet. So you have -- you see this steep thing that is created by the Kriging process.

NIOU: My point was, when you assign a level of minus 2,000, will water tend to move towards that direction because of the --

MONTAZER: No. Those are inactive cells. Don't even enter into the equations in the model.

NIOU: Okay.

MONTAZER: In Mod Flow, when you said inactive -- the only reason we said we give that number is an identifier so when you do the printouts you know those results are inactive cells. And minus 2,000 is -- obviously, we don't have any minus 2,000 water levels. That's why we use minus 2,000. We could have used minus 999 or whatever.

NIOU: What's that horizontal line?

MONTAZER: This is the -- this pink? This is the boundary --

NIOU: No. The horizontal line.

MONTAZER: Oh. This is the barrier that we've had to put to separate out the -- see, these wells --

NIOU: Oh, up there.

MONTAZER: Much higher water, piezometric head.

BURIL: Like Perry said, we don't know if it's geologic or depositional or just what it is, but we had to put it in there in order to account for it.

NIOU: Yes, I think these are important for me to understand your model.

BURIL: Sure.

NIOU: Also, like the previous map, you also have a dark spot.

MONTAZER: That is created -- that's a mounding that's also created because of this feature.

NIOU: Because of.

MONTAZER: Yeah.

NIOU: Okay. Same thing.

MONTAZER: Because of that feature.

NIOU: Okay.

MONTAZER: And it changes over time depending on

how much pumping there is, how much recharge there is.

NIOU: So you do have that for all three layers?

MONTAZER: We have it for all three, right.

NIOU: The artificial.

MONTAZER: For the entire eight periods, in this case, the eight months that we had, we did the calibration. We have it for every one of them. I'm just not -- I haven't printed all of them. Michelle has the entire, the whole package.

You brought the whole package. Right?

COLBERT: Uh-huh.

MONTAZER: That would be -- that would make a lot of graphs, though, just to show some examples. But for every month we produce a contour map from the calibration.

NIOU: Okay.

MONTAZER: Calibration runs.

I guess these -- I'm not going to go through all this. You want me to go through these individuals? Do you want to just wrap up?

BURIL: I think it might be best for the folks to be able to take a look at it at their leisure and if they have any questions, then we can field them then.

You've got conclusions on there.

MONTAZER: Yeah. In the majority of the area of interest the calibration is within 20 feet. It's plus or minus 20 feet. And the top aquifer is less than that. We have plus-minus 10 feet. In some of the deeper, the third layer, the maximum we have is about 40 feet in some of the -- couple of the stress periods in one of the wells, in the well, I think 19, which is on the southeast part of it --

CUTLER: It's not as critical as 18.

MONTAZER: -- which is not as critical.

Spending time, you can fix these things. The question is the amount of effort and the return that is -- whether it's worth spending that amount of time calibrating it, which we can -- when we do the -- when you do the -- like the scenario analysis, we're going to have to do uncertainty analysis anyway. And those variations will be included in the range of -- the uncertainty analysis. For example, for your -- we're considering that the certain case that we have -- we have to consider for pumping scenario, we change the -- some of the parameters by the percentage that have -- has caused those variations, those separations. And you'll see the ranges as a result,

like plus or minus this many percentage as far as the cleanup, for example, objective is concerned.

So for that reason I think we're -- you know, we can spend a lot more -- several more years trying to refine this calibration, but I think we can address the uncertainties in the -- when we do the uncertainty analysis.

NIOU: When you prepare your write-up, I would appreciate it, if you can, for instance, where you put in the inactive cells and the rationale for doing that, and also where you put like those things I ask west of W-18 in order to block out mound up there, to state out you did that, and just a brief discussion what's in fact to the local situation.

MONTAZER: Right.

NIOU: So that we may understand. Because I understand you have to do that. Modeling, sometime you have to put in artificial scenario, something there, in order to calibrate. But if you discuss so that we may feel, okay, we're comfortable with this.

MONTAZER: Mark, do you want to mention about the report that -- the report describes all of that. The only thing different we have done is we just have done a little bit more massaging of the model. But the report stays the same. If you want to

re-issue the report all we have to do is change those graphics, and the write-up is the same.

BURIL: In fact, the report, I was anticipating, would incorporate that, portions of that in the FS as the descriptor of how the model worked, and so forth.

The purpose of this was to give you folks the introduction of what we're doing, you know, what the model is, how it's been worked and give you some introduction as to the accuracy that you might be able to expect, and so forth. But the actual use of the model for determining remedial alternatives and so forth, that will be in the FS.

MONTAZER: This last one is just a wish list. If the water agencies come up with a -- they may want to run a spin log or something like that when they're doing --

BURIL: They probably want us to do that.

MONTAZER: If somebody comes up with the money, that will give us a little bit more confidence as far as understanding the pumping from these different zones.

That's about all I have. I guess questions, any more discussions?

BURIL: Any questions for Perry?

RIPPERDA: A couple. What are your upgradient and downgradient boundary conditions?

MONTAZER: Actually, the way -- because this is some of the model -- this figure, that shows a little bit of boundaries.

The entire surrounding, except this southern part or southeastern part, the entire thing is no-flow boundary.

RIPPERDA: I understand the crystalline rock no flow.

MONTAZER: Right.

RIPPERDA: But even upgradient and downgradient it's --

MONTAZER: Yeah. Everything is no-flow boundary. The way -- and we had to do that, and I'll explain why. The only place that we have constant head, and this is on the -- what we have said only constant head at the bottom layer, the aquifer number 3. The others are open. And the reason we have done that is water level fluctuates, even at the boundaries, over time. If I faced these as constant head, then it would be constant head.

But in order for me to do transient analysis, I have incorporated flux boundaries in here. So these -- this yellow line, which we call

recharge, but they're really fluxes that come in, partly coming from horizontally, partly coming from -- in this case there was -- there's that golf course. And there's a little bit that comes from up on the northeastern part.

But the majority of the water flows out to this --

RIPPERDA: So you always have a constant flux that's not drawn? I'm not seeing that part?

MONTAZER: No. This is constant head.

RIPPERDA: Okay.

MONTAZER: Down in here, in layer 4 only --

RIPPERDA: I get it.

MONTAZER: -- I mean layer 3. The bottom layer is constant head. And the others have no-flow boundary. So the head in them is controlled by whatever water that comes in and goes through that constant head. We assumed that was good enough because it's far away from -- so the inaccurateness over here is not going to really affect --

RIPPERDA: How about CH2M Hill model, running that at a steady state condition and figuring out what the flux through the --

MONTAZER: Really, there's nothing in this model that is left from -- we started from CH2M Hill and

there were Foster Wheeler, some of the people working on it before they converted all the -- they brought -- they imported all the CH2M Hill. There's not much left of CH2M Hill data because calibrations changed everything. The only thing that is left was the boundary, the physical boundaries of the bottom of the aquifer and things like that.

CUTLER: The Hill model didn't have very much data right around the site. We had a lot more data around the site.

RIPPERDA: I don't care about around the site. I just care about like long-range stability. Like, if you don't have any pumping, does this stay stable over a few hundred years?

MONTAZER: Yeah. That's -- we did the steady state and the comparison with the CH2M Hill, all those. Yeah. Those were done early on.

RIPPERDA: Okay.

MONTAZER: Those tasks. But when we did pumping, et cetera, is -- their pumping scenario, system, the way they're pumping is totally different. And they don't have enough resolution in this area to even compare. I think we have like maximum of ten nodes, five or six nodes that cover this whole area on the CH2M Hill model. Doesn't

have the details.

NIOU: So you have a recharge boundary at --

MONTAZER: Right.

NIOU: -- that area and south of that's no flow?

MONTAZER: Yeah. Down in here is all no flow.

NIOU: All no flow.

MONTAZER: Right.

NIOU: Recharge and one point recharge at the east, the northeast, and then constant head. Okay.

But do you have any head where water level measurements at the -- near the west, in that area?

MONTAZER: Yes. There are wells in here. There are wells in here that we had to -- we used for calibration.

NIOU: Okay.

MONTAZER: The wells that are in here really decide what the flux in here, the input would be the same.

NIOU: Okay.

MONTAZER: But I don't have anything down in here. So that's -- this area is really not calibrated.

BURIL: Any other questions?

Okay. Great. Thanks, Perry.

MONTAZER: All right.

RIPPERDA: So you have run this for future stuff just to get --

BURIL: Yes. We've gotten a feel for it. I'll share with you that we asked Perry to run it and tell us what gallon per minute flow would actually potentially allow us to cover the bulk of the site where the contaminants are. And if memory serves correctly, somewhere between 450 and 500 gpm was sufficient to influence the entire area of JPL.

So that may be the beginning of the basis of, say, a hot spot removal kind of approach or something like that. That's something we're going to continue to look at as we go, get deeper into the FS.

RIPPERDA: When you say that flow rate, that's within the center of JPL, or that's the existing Arroyo Seco wells?

BURIL: No, no. That would be a well placed somewhere here on JPL. We are still looking at the idea of incorporating something with the City of Pasadena, potentially the Arroyo well. We haven't really gotten into that one yet. That carries with it a lot of logistical problems that we just have started going to the City of Pasadena and talking with them about just in these last few weeks.

We'll talk a little bit more about that when we get down to the report about the perchlorate study. I have a request on the table from the City of Pasadena that I wanted to pass by you folks and be sure that you were knowledgeable about what is happening and what the implications might be for this process.

Okay.

CUTLER: I guess, Perry, if you wanted to -- if there's no more questions, if you want to take off --

BURIL: Yes, you don't need to stay.

CUTLER: We don't have to hold you.

BURIL: You can beat the traffic.

ROBLES: It's not that we don't like you.

MONTAZER: If you want I stay, but --

BURIL: There's no need.

If you're charging by the hour, go.

MONTAZER: The minute, should I say.

BURIL: Oh, okay.

MONTAZER: Okay. All right. Do you need anything?

BURIL: I think we've got everything under control. We're all done. Thank you.

(Discussion held outside the record.)

BURIL: Why don't we take a 10-minute break.

(A recess was taken from 10:22 a.m. until 10:36 a.m.)

(Mr. Montazer and Ms. Colbert departed.)

BURIL: Let's go ahead and move on here to the second item.

On the second annual groundwater report, annual groundwater annual report. Department of redundancy department.

We have submitted that to you folks, I think, have we not?

NIOU: Yes.

GEBERT: Yes.

BURIL: Comments with regard to the content, if you have any.

Mark, you had some specifics on that or --

CUTLER: Well, according to the FSAP, after a year we were going to make a proposal to change the sampling frequency, maybe the analyses, that type of thing. Well, it was decided to go at least two years. So we waited until the second annual report to make some recommendations.

So we were curious if you guys had a chance to look at that and to say yes or no, can we make those changes.

NIOU: I only look at it like this. But actually, in my opinion, I do not have a problem with that. Because your concentrations are stable. Other than perchlorate, everything else either stable or lowered. And therefore, in my opinion, not yours, lowering your frequency is --

CUTLER: I think if you'll look, what we proposed in the long-term monitoring program plan in the FSAP we are including more. It said if you had a well that's downgradient or something, you could do it biannually. Well, talking with Chuck and getting approval, we're going to do it quarterly. So we're doing more than what the original plan says. We're being more conservative.

I think if you look through it with some time you'll see it's a very conservative plan.

GEBERT: Yeah, I looked through it. I have really no concerns. You know, you're going from an investigative phase and getting into more the monitoring type of data gathering. So the only reservation I kind of have is dropping the lead and arsenic totally.

CUTLER: Well, that was -- I think it was totally. I can't remember if it was annually or we dropped it totally.

GEBERT: It was totally. I thought maybe you could sample annually just to keep an eye on those two.

CUTLER: Just to keep a check on it.

GEBERT: Yeah. Other than that --

BURIL: That's reasonable.

ROBLES: It's reasonable.

CUTLER: Just to refresh your memory, if you haven't had a chance to look at it, in the last two years every screen that ever had a detect of the kind of COCs, kind of the contaminants, not these strange, weird ones that show up now and then, the acetones or the MEK, or some lab contaminants, that was considered a plume well, very conservative. At every screen above it or below it was considered like a downgradient screen, even though we've never had signs of, you know, upward flow vertically. So those are going to be continued doing quarterly. It was only the screens, another screen away that would be done once a year. So if you looked at it that way, it covers everything pretty well.

NIOU: Actually, I was surprised that arsenic normally for southwest has a background level. But here you don't have much.

BURIL: We've only got one location.

CUTLER: There's no evidence of a plume on either lead or arsenic. It's all background stuff, in our opinion.

But if it's okay with you guys, we can certainly do that once a year.

BURIL: Mark, why don't you go ahead and put together, with the other discussion we had here, put together another proposed program and just kind of lay it out for us so that it incorporates what we just discussed. And we can send it out.

CUTLER: We can make a revision to this?

BURIL: Yes. That's fine.

CUTLER: The second interim report?

BURIL: Yes. Just something that I can give to the folks and say, "Okay. Based on our discussion, this is what we will do from this point forward."

CUTLER: Or just an addendum to this.

ROBLES: Yes.

BURIL: Just a letter.

CUTLER: Yes, that's what I'm thinking.

RIPPERDA: I haven't looked at it. So is there the request in there for changing? Or is that what you're talking about putting together in a letter now?

BURIL: Putting it together, yes. The approach

was that we would automatically look at it each year. And this is what we're talking about now.

GEBERT: Do you want a letter from us approving --

BURIL: Concurring the change.

GEBERT: Concurring with the changes.

ROBLES: When you get it.

CUTLER: We would like to know, if possible, before.

CARLOS: The second annual report, I recall there was some recommendations on what changes you want to make.

BURIL: Yes.

CUTLER: Yes. It's in the report itself.

BURIL: So take a look at it again, refresh your memories and we'll send out this, quote-unquote, formal request to make those changes. And then if you folks can approve that, we'll be in good shape.

RIPPERDA: Okay.

BURIL: Anything else on that annual report?

CUTLER: No. Just refresh my memory. We're going to do the anions and cations once a year? Anyway, we'll lay it out again.

BURIL: Let's go ahead and move on to number 3, then. I'll pass out this schedule of deliverables

that we've changed.

Let me explain what we did. In taking the four months into account for the RI, Mark pointed out, and I agreed with him, that major schedule impacts to the FS and subsequent documents really probably aren't necessary with this extension for the risk assessment.

But one of the things that struck me in looking at this is that this risk assessment approach of -- the risk isopleths, I haven't seen it before and, as I recall, Dan Stralka was indicating that may be a useful tool to help focus remedial actions. I don't know that that's going to be the case. I don't know that it's not.

But in looking at that, I would like to have the analysis at least complete to be able to take that information and factor it into the FS, if indeed it factors in. But we don't need the full four months to do that. We'll have it done in half that time as far as having the knowledge to be able to utilize and factor into the FS.

So what we've done is for the FS report for OUs 1 and 3, and then the subsequent things from that, we've postponed that by two months as opposed to the four months so that we could have that

analysis factored into it. The draft-final RI has the four months built in. If we can complete that faster, we will. We will get it out to you as soon as we can possibly complete it. But this is what we've already submitted to you as a request. We've gotten letters back from some of you folks saying okay.

So that's where we're at right now. And I'd entertain any questions you might have about what it's all about.

CARLOS: Have you received our approval?

BURIL: Yes, I think we did. I think you were one of them.

GEBERT: Ours, I think, was mailed yesterday.

RIPPERDA: You got mine, right?

BURIL: Yes.

RIPPERDA: Okay.

BURIL: Your comment on the second paragraph is what prompted real introspection as to just how much time do we need for the FS. Just to be able to say that, yes, we did this analysis, we took it into account in the FS as was suggested by Dan. We didn't just do it for show. It's actually intricately part of what we took into account. And I think that will work out.

Taking a couple of months just to get the analysis done, the rest of the time is developing the pictures and getting it reviewed and all of that. And we don't need to do that to slow down the FS or need to deal with that and slow down the FS. So that's the approach we took with this right now.

RIPPERDA: That sounds good. Dan will be happy. If Dan is happy, I'll be happy.

ROBLES: Everybody is happy.

BURIL: Okay. That's good.

GEBERT: So it only results in a delay of two months.

BURIL: Of two months to subsequent documents to the RI.

GEBERT: For the FS.

BURIL: Yes.

RIPPERDA: It would actually look rather silly if --

BURIL: We did all the work and we then ignored it.

RIPPERDA: -- came right out with the FS even though -- I thought about this, and philosophically, I think Dan's isopleth approach is great. But I think for multi-level, multi-layer aquifer cleanup, MCLs are always good, the driver. On the topic of

risk distributed throughout an aquifer, I agree with you it's somewhat specious, but I'm glad to see you guys --

ROBLES: We've got to go through it because of the public concern.

BURIL: We'll go through the exercise.

ROBLES: It's going to be a question asked by the public. It goes to a question asked by the lawyers, so we want to make sure that we cover our bases.

BURIL: The biggest thing, in my mind, is that as we come to the point of going public with a proposed plan and sitting in whatever meetings we might develop is I want to be sure that we're all working as a team and we're shoulder to shoulder as opposed to eye to eye on this. I think that, you know, going through this exercise, while philosophically it may work and it may not, we don't know until we do it, it certainly makes more sense to have satisfied all the concerns so that there wasn't anything hanging out there.

ROBLES: We should expect that when these documents go out to the public that we're going to get some other comments. They'll say "Well, why didn't you think about this?" and we're going to

have to go through the same exercise again. Because ultimately we have to stand together and the public has to be satisfied that we've addressed their concern. Even if it may seem to be a futile exercise, we've got to do it.

NIOU: Chuck, can I have an RI OU-2 today?

BURIL: Oh, you didn't get the OU-2 RI?

NIOU: No.

BURIL: Oh. How did that happen? You bet. I'm surprised. Did we send you two copies, Mark?

RIPPERDA: No.

NOVELLY: I thought we sent it directly to Stephen.

BURIL: We'd have to go back and look.

NOVELLY: That was the request, that we send it directly to him.

BURIL: Yes. I remember you said you were going to be out of town so send it directly to him.

Did you move?

NIOU: No. Will be next month. But so far I'm still at the old address.

BURIL: I'm surprised. I wish you had called me and told me that you hadn't received it.

NIOU: I didn't know because I didn't come to meetings.

BURIL: Oh. Okay. Yes.

NIOU: So I didn't know anything until he asked me "Did you review your RI OU-2?" "What?"

BURIL: Oh, my gosh. Okay. I hope that we have a -- I'm 90 percent sure we've got an extra copy there in my office.

NIOU: After the meeting I'll get it.

BURIL: Just come on down and we'll dig one up for you.

NIOU: Okay. Thanks.

GEBERT: On the OU-2 RI, agency comments are due I think middle of April. Correct?

ROBLES: Yes.

BURIL: That sounds right.

B.G., does that sound right to you, middle of April? Yes, because we submitted it on February 17th, I think, wasn't it? That's 60 days from then, so yes, middle of April. Tax day.

NIOU: Great.

BURIL: Lovely way to remember it.

CARLOS: If we need additional time, is there a 30-day extension?

BURIL: It's available to you in the FFA. If things really go to hell, so to speak, then we can get together on a phone conference and discuss how

to do it. It's very open as far as the mechanism in the FFA. So hopefully that shouldn't be a problem.

CARLOS: We started looking at the draft OU-2. But just in case we need additional time.

BURIL: Sure. Sure. That's fine. Okay.

So schedule sounds good. We'll assume that everything is copacetic on that.

Then let's update you on the soil vapor stuff.

B.G., do you have these handouts here that you can give out?

RANDOLPH: Yes. I've got some details from the last two sessions that we have, field from last October, and then again what we just completed a week ago.

And when you compare the two you'll see that the extended soil vapor pilot test is pulling pounds and pounds and pounds out of the ground. Very obvious.

BURIL: As a matter of fact, just a quick note on that extended vapor pilot. It's continuing to run and I believe that its stop time is some -- some time I don't recall.

RANDOLPH: Yes. They just changed out the carbon on it.

BURIL: But it runs 24-7 and it is really doing a job, based on looking at this.

NIOU: Because I haven't been here for some time, may I ask the current flow rate, like pounds per day, some information like that? Update it, because I'm out of touch for some time.

BURIL: I'm not sure. B.G., do you have that information available with you?

RANDOLPH: No, I do not.

BURIL: It's unfortunate. The fellow who would have it, Vitthal Hosangadi, he just had a baby. Not he, but his wife. He is playing new daddy, and he's not able to come to the meeting today, unfortunately. He'd be the one who would be able to answer those questions right off the top of his head.

RANDOLPH: There were complications with the birth of the baby and it just got out of the hospital. It was born quite a bit premature and was released early and it caught him by surprise. So he was unprepared for the baby and the wife coming home, or the baby coming home.

NIOU: Is there any way that he can e-mail me, simply e-mail me like the basic parameters, the operational conditions of the SVE?

RIPPERDA: Before we get into that, is this going to be continuing for a while? Is there like some kind of report that's scheduled to come out?

RANDOLPH: There was a report that was going to come out, the very first one, and then it was delayed because of the extension. I'm not sure of what the schedule is on that right at this time.

RIPPERDA: How long is this test going to run?

CUTLER: It's my understanding it's going to run into August.

RANDOLPH: Yes.

GEBERT: I know it was extended because of the radius of influence.

BURIL: Yes. It was so incredibly large that we just didn't believe it.

GEBERT: Has that gotten smaller?

BURIL: I don't know, to be honest with you. It hasn't?

CUTLER: I think if you look here it's pretty much doing a job everywhere.

RANDOLPH: It really hasn't. In places like in 39, it's not very noticeable. 37, 38 and 39. But all around it up to the range of several hundred feet it's pulling in vapors like crazy.

CUTLER: Because of the huge radius, to get

those pore volumes and this type of thing --

RANDOLPH: Right.

CUTLER: -- you need the time. That's one of the main reasons.

RANDOLPH: Right.

BURIL: Just looking at the visual impact of this, if you will, you look at the gray areas on this one versus the other, and it's dramatic. Dramatic change. So it appears to be working.

The nice thing is I think we could all report back to our individual managements that we are effectively cleaning up something here during the course of time that we're testing. So there's a benefit. So that is -- while we may not be rushing headlong to ROD, we certainly have something that's effecting some real change and some real cleanup, which I think is a positive aspect.

CUTLER: It would be interesting to see if this impacts the groundwater.

CARLOS: I'm curious. Have you seen any decrease in concentrations?

CUTLER: Not noticeable. Not something you can see is a definite trend. But we just finished an event yesterday, was the last day we scheduled in the field getting water levels, and finished up the

sampling not long before that. So it will be -- this next sampling event will be the first time we might see some changes.

CARLOS: When they take the vapor measurements, is this under dynamic conditions, or they shut off the system?

BURIL: We shut it down.

RANDOLPH: We shut it down.

CARLOS: For how long?

BURIL: Two weeks.

RANDOLPH: It was shut down a week before we started sampling. It was shut down all during sampling and hasn't really started yet. We'll be starting either late this week or first of next week.

BURIL: Okay. Anything else on the vapor report?

NIOU: Like I said, can I have the gentleman's name and telephone number so that I can -- or e-mail address so I can try to get some updated information for the SVE?

RANDOLPH: I don't --

BURIL: He just wants Vitthal's number.

RANDOLPH: Yes. I've got it. It's in my briefcase.

CUTLER: We can get that for you.

BURIL: Just catch him after the meeting.

NIOU: Okay. Because then I can talk to him. That will help me to review the RI OU-2.

BURIL: Okay. That's no big deal.

Any other questions or comments on that little quick update?

Let me move on to the perchlorate study. I'll tell you that the Calgon folks are gone. They're off site. They have been for a while now. I just got their draft report in house the middle of last week.

Basically, their report is somewhat incomplete. I'm going to be giving them my comments back next week and Foster Wheeler is also looking at it.

But overall, what we came up with was actually quite exciting. The system, when we went ahead and used the ISEP, which was the continuous ion exchange mechanism, the carousel, that worked very, very well and we were able to get the waste rate down to about 2 percent. Now, I say waste. I mean that the actual brine that's used to regenerate the ion exchange resins was at about 2 percent of the process flow. In other words, we could

regenerate with -- if we were at 10 gallons a minute, we could regenerate with .2 gallons a minute of brine at a 7 percent sodium chloride solution. And it worked very well.

In fact, that was at 1200 parts per billion. We actually spiked the influent concentrations to get up that high because we have seen it that high in Well 16. And I wanted to be sure that we could handle anything that we would see here on site, because I'm viewing this principally as an on-site remedial issue. The outfall it may have with the water purveyors in the area may be of some interest. So that worked very well. We were able to optimize that.

During the course of time, toward the end of the project Calgon came up with their catalytic system, which was to regenerate the brine itself, in other words, recycle it. And the mechanism that was used was a proprietary catalyst which had platinum and another metal, which I can't recall right now, on a ceramic substrate. And they would introduce the brine at elevated temperature and pressure, somewhere around 250 pounds and 200 degrees C. And they would also inject a very small portion of ethanol as a reductant to basically force the

reaction to break down the perchlorate. And as it turns out, it breaks down nitrate as well because the resins also strip nitrate.

So we have this reaction occurring. We built the chamber. And it was made of Hastalloy. That thing is not cheap, by the way. It's $90,000 by itself. And we ran the tests here.

We were able to optimize that thing to the point where it removed better than 95 percent of the perchlorate and the nitrate out of the brine.

ROBLES: So 95 percent of 2 percent?

BURIL: No. What you've got now is you've got 95 percent of the concentration removed.

ROBLES: Okay.

BURIL: That's in a flow that's equivalent to 2 percent of your process flow.

ROBLES: Okay.

BURIL: Now, the other part that still is a concern is sulfate. And while we don't have large sulfate quantities in the process water, when you concentrate them on the resin and strip them with the brine and then try to reuse it, you could conceivably end up affecting the resins. So we needed some mechanism to get rid of the sulfate as well. We utilized a nanofiltration unit and the

nanofiltration unit was able to knock out 90-plus percent of the sulfate out of the sodium chloride stream.

So we now had what was a reasonably purified brine that we could put right back into the system for regenerating the resins.

When we did that, we generated a very small stream off of the nanofiltration. Basically it was the sulfate-rich sidestream from knocking out the sulfates. That quantity turned out to be about 10 percent of the brine flow through the nanofiltration.

So if you take the fact that the brine flow through the resins is 2 percent of the process stream, then you are able to recycle 90 percent of that, so that your actual waste stream coming off is .2 percent.

NIOU: That's good.

BURIL: For a 1,000 gallon a minute stream we got a 2 gallon a minute waste stream.

ROBLES: That's not bad.

BURIL: That is fabulous. Unbelievable. Usually in ion exchange systems where you don't have any kind of brine to cycle you're looking at anywhere between 8 and 20 percent, 10 being kind of

a standard number.

So we're orders of magnitude under that, which could be a very, very beneficial thing considering that we don't have any means of disposal of brine immediately available to us here, like a brine line or something like that.

So we are reasonably enthused by that, but we are not putting all our eggs in one basket, either. We are also testing biological approaches, reverse osmosis. Mark Losi is dealing with that, as well as Mark Cutler. And depending upon the economics that this all comes out, we will probably make some kind of determination as to what we want to go with.

Basically, the system that I've just described, according to Calgon, will treat water at about a cost of $200 an acre-foot. Now, that's not fabulous, but it's not bad. That's in the realm of reason. Biological treatment may actually be cheaper. The AeroJet plant that's built up in Rancho Cordova has been in operation for a little while now, and they reported out at a perchlorate conference last week that they're able to deal with about an $80 per acre-foot cost. But that water is reinjected into the ground and there is not a lot of

concern about the quality of the water in terms of biomass or things of that manner. They knock the biomass out down to acceptable levels. Department of Health Services has indicated some reluctance to permit it to actually turn over directly to water purveyors for distribution to their customers.

The ion exchange system that we're talking about here, there would be very little concern about that. In fact, the water that comes off of that is probably better than what you can buy in a bottle in the grocery store.

So we're in the process of finishing that off. All of that information will be provided in the FS and when I have the Calgon study report finalized, I'll be sending copies of it to each of you so you have that as well.

Overall it looked very, very positive. In fact, Calgon has already sold one of these things to the La Puente Valley County Water District, which is out east of here. Now, they didn't sell the brine recycling system, but they did sell the ISEP system. And, in fact, that thing is supposed to be in operation come June or July of this year. And it's a 2500 gallon a minute system.

ROBLES: And the waste is going to be --

BURIL: They have access to a local brine line. They're only a very short distance from a brine line out in that area. So they're going to waste all their brine. We don't have that access here, that I'm aware of. I think the nearest brine line is like three miles away. So building a three-mile pipeline is just a little prohibitive. So that's why the recycling aspect was so important to us.

But again, like I said, we're not placing all our eggs in one basket. We've got other studies that we're doing to evaluate other possibilities, and those will be presented in the FS.

ROBLES: Talk about Pasadena.

BURIL: Great segue. Thank you.

I did want to mention that we had a contact from the City of Pasadena. Brad Bowman, who is the fellow who is in charge of water operations particularly here in the Arroyo, had been in contact with Peter and I on a periodic basis while the Calgon study was going on. And we were keeping him informed of how well it's working, and so forth.

Well, now that it's done and it's very successful, it's Pasadena's desire to have the treatment installed on their wells that are currently either in jeopardy of being shut down or

are already shut down for perchlorate, the idea being that in order to facilitate this, Pasadena would allow the plants to be built on their property, which is located at the Windsor Reservoir. That's actually one of the four wells that are fed into the current VOC system that we have in place.

Now, all the water from the VOC plant that's currently in place does go directly to Windsor Reservoir. So it would be a matter of replumbing to put it into whatever kind of perchlorate treatment plant we might want to put into place.

Also, what they offered is that if we were to place some form of remediation here at JPL in the form of a hot spot removal or whatever, that they have an existing line that comes to their filtration plant right up here on the hill and another one that comes from a filtration plant down to the headwaters of their spreading basins. What their suggestion was that if we tied into that, we could then plumb through their piping up to the Windsor Reservoir, because there is a line from that filtration plant up to Windsor.

They would allow us to then have a plant dealing with perchlorate of sufficient capacity to

deal with all four of their wells as well as our own discharge. The discharge that would come from that combined flow or any combination of flows from the wells would either go to the Windsor Reservoir for storage and ultimate distribution to their customers or, alternatively, may even supply water for certain water features which the City of Pasadena wants to install in the Arroyo Seco as part of the Hahamongna Park refurbishment.

So they had asked to get a meeting together in early April and just to discuss the possibilities. And that carried with it a lot of ramifications, not the least of which is that this seems to be a very, very presumptive remedy for perchlorate in terms of the kind of work that we are doing here. So I wanted to bring this to your attention and give you the spiel that I've just done and hear what your reaction to this kind of a proposal is and what concerns you may have just based on this brief description of the city's proposal.

ROBLES: Or to go back to your people and query them, do they have a concern on this as well.

BURIL: Right. Any thoughts, comments on that kind of approach?

RIPPERDA: Just logistically, you guys know much more about this than any of us, so all their different plumbing and pipes that you're talking about that you would have access to, would there be times of the year when they're using it to bring water to the spreading basin that you wouldn't be able to be going through it?

BURIL: Supposedly not. The filtration plant that they have up there was designed to take water from the watershed above Altadena, and they would drop out sediment and then they would plumb it over to the Windsor Reservoir.

Well, as it turns out, it's much more effective for them to just put that water directly into the spreading basins and allow it to percolate. Through water credits and agreements with other agencies and so forth, it's actually more beneficial for them to spread it than it is to allow primary sedimentation and then put it into their system.

Supposedly, we would not have that particular concern because that filtration plant has not been used now since my tenure here at JPL, which is going on eight years.

ROBLES: I looked at it personally, and my opinion is I would still want a treatment here on

site even though we may plumb them together, again, if something would happen. But the idea is that it would allow us to be able to tie all their four wells together. So therefore, they would not have a perchlorate issue. And it would also mean that we would be acting at the end of the plume. So we would have something here, either going there or worked here. But we would be dealing with both ends of the plume and that would provide a mechanism to basically handle the hot spot removal and the plume source as well.

GEBERT: Have any of the other people that are in the basin been informed of this, or do you have any --

BURIL: No. We haven't talked to them because it was purely a City of Pasadena kind of issue. Obviously, your question is actually a very poignant one because folks like Lincoln Avenue Water may have a great deal to say about the fact that Pasadena gets treatment and they don't. To my knowledge, Pasadena has had the only wells in the area shut down for perchlorate concerns. A few of them have gotten close. And Lincoln Avenue's, I think, were up to 13 or 15 parts at one point, but then they went back down.

The Arroyo well for Pasadena, the closest one to JPL, has been shut down now for maybe two years in July. So there is an obvious problem with Pasadena's wells, but not so obvious a problem with Lincoln Avenue's wells. And the mechanism behind that is still something of a mystery, but I think that the geologic structures that we're dealing with in the aquifer as well as the differences in screened intervals and pump placement and so forth are enough to more or less keep the Lincoln Avenue wells out of danger, so to speak.

Anyway, the upshot of it is that they've never exceeded the 18.

RIPPERDA: How about adjudication issues, pumping out of the aquifer?

ROBLES: That's going to be a part of it.

BURIL: That's another part of it, too.

ROBLES: Because, basically, I know that the Raymond Basin is going to have a hard problem, which is having one purveyor, their main purveyor, Pasadena, basically getting all the tretment. We're still working on the negotiation with Lincoln Avenue, which I'm getting very frustrated with them. But the key is that they made this proposal. What we're trying to do is see is it feasible.

The biggest hurdle is that this is just an employee within their organization. This does not have the buy-in of the City Council, which is my biggest concern. And there are, you know, public meetings that have to be set up and people that are going to argue the point. And Raymond Basin is going to have something to say about that as well.

So what we're doing is first see is it feasible, is it possible, is it something that has any chance to see the light of day. If it doesn't, we're not bringing it up. Why stir a hornet's nest. But if it does have a possibility, we want to present it to Raymond Basin, look it over. And then comes the logistical issues, then we have to go to my organization. Do we have the money for this, because this is a major infrastructure investment, and even see if we can maybe convince Lincoln Avenue to tie their pipes into this, which I doubt.

BURIL: No.

ROBLES: The potential there, just the concept is so attractive to be able to have something in there that we can tie all the four wells together and deal with the plume at that end and keep those pumps going. That means that we basically stop any more migration that way. And then dealing with

source reduction, we basically have done it. The key is we don't want it to appear to be a presumptive remedy.

CUTLER: I was going to say the same thing.

ROBLES: That's the other thing that we're very much concerned about. So how does this tie in? We don't want it to appear that we've already stacked the deck in one arena and somebody says "You haven't thought about these others."

CUTLER: There might be some ways to optimize those types of ideas.

ROBLES: Right. Right. We want to make sure. We don't see this happening very soon. I mean, dealing with city government, that takes a lot of time.

BURIL: I think the big thing is that given this concept, it has some fairly dramatic implications to the Superfund process overall. And if there was something that jumped up in your minds or from somebody in your agency that upon hearing this would say "No, that won't work because," then, as Pete said, it would be a fool's errand to pursue it.

So we would kind of like to know from you folks up front as soon as possible what kind of potential problems you might see. If you don't see

any, that's fine. But if from your agencies' perspective there are potential problems, we would like to know about those.

This is new ground for me to a certain extent. I have not gone into cooperative agreements quite this extensive with other municipalities. And I've talked with folks at Lockheed, who have something similar with the City of Burbank, but not quite this extensive. And they said the logistics of it were really quite difficult to work out.

So anyway, if you folks have any immediate thoughts.

NIOU: Let me just ask a quick question. Is the proposal meaning that you simply just pump the water out? Say if you have a well at a hot spot, just pump it out, send to the pond or something?

BURIL: What we would do with anything that came from JPL, first -- maybe I didn't mention this. We would first have to knock out the organics here.

NIOU: Oh. So it's only for the perchlorate.

BURIL: So it's only for the perchlorate that we could send it over there. The existing VOC plant does not have the capacity to take any discharge from us as well as all four discharges from the four Pasadena wells. It's basically limited to 7,000

gallons a minute. And those four wells that are tied to it can push it right to its limit.

ROBLES: So what we would do is take that water from them, put it into a perchlorate plant that we might work into a cooperative agreement with them and then also pipe our perchlorate, after we've knocked out our contamination here, into one central location. The reason for it is because the Calgon system, so to speak, it's more conducive. Instead of having two plants we'll have economy of scale and build it with enough capacity to handle what they have, what we have and what anybody else has, particularly Lincoln Avenue, is what I'm looking at.

Our other option would be to go back and refurbish the actual VOC plant that they have now to handle their perchlorate. But that would only be enough. We would have to upgrade everything. That's a major reinvestment instead of just putting a new investment in there as a capital investment. And the land, they said, hey, we can use what we have already. There's infrastructure there. So there's some cost savings and economy of scale in that sense. That's what we're going to be looking at. But again, it's just an option.

My biggest concern, as with Mark, is we

have to comply with the NCP. We cannot appear that we're preempting the presumptive remedy. That's the problem that I'm very much concerned about. Because that, I think, is going to be the biggest issue for us, is we have to make sure that we cross our "t"s and dot our "i"s when we go to the public, that it doesn't appear that we have already stacked the deck to a certain technology. Because I know right out there there's a lot of concern about that; have we looked at all of the technologies to be able to deal with the matrix of contamination.

CUTLER: That could be in your best interest as well.

ROBLES: Sure. It may be too early to discuss it. What we're looking at, is it possible? Is there any possibility?

NIOU: You can do a feasibility study for the current situation.

ROBLES: Sure, as a treatability study or as an interim removal action or something else. The only problem is, this is a capital investment of such magnitude.

BURIL: Let me give you an idea. Calgon has plants that they can build what are basically modular, and they come in various flow rates. The

biggest one that they make is about 4,000 gpm. So you would need two of those, which would give you the 7,000 gallons a minute that's capable of being produced through the VOC plant with a 1,000 gallon a minute buffer, so to speak, to take up anything that might come from JPL.

That 4,000 gallon a minute plant, while I haven't seen any cost figures, I would imagine it's probably about half again the cost of the 2500 gallon a minute plant that's going in at La Puente. That's just kind of taking into account the economy of scale, and so forth.

The La Puente plant, the ISEP portion of it is somewhere between one and a half and two and a quarter million dollars. So just call it two. So now if we go up to a 4,000 gallon a minute plant, that's now $3 million per plant. That doesn't include the regeneration module for the brine, which is probably going to be no cheap piece of equipment, particularly since it's got to be made out of one of the most expensive alloys known to man.

ROBLES: 4 million.

BURIL: So you're easily looking at --

ROBLES: 4 million.

BURIL: Yes. You're looking at an 8- to $10

million potential investment.

ROBLES: With all the other incidentals, we're talking $10 million as a minimum.

NIOU: For a treatability study.

BURIL: To even begin to talk about implementing something like that.

ROBLES: Think about just that alone. 10 million for a treatability study. What's wrong with this picture?

NIOU: Okay. I got the picture now.

BURIL: Now you see why we're kind of concerned, at the same time interested.

NIOU: If it's several hundred thousand dollars, anybody can buy that.

BURIL: We spent $350,000 on the Calgon study. That's not an unreasonable number.

NIOU: But 10 million.

BURIL: That's our concern.

CUTLER: And Chuck also has other studies going on. I don't know if you want Mark to just kind of bring up some of those.

BURIL: Mark, why don't you bring us up to date on some of the others.

CUTLER: It's a little too early yet.

LOSI: It's early, but there's no data yet. I

haven't got any data. But we're setting up several studies. One of them is reverse osmosis, which is generally considered to be the only other treatment to date for perchlorate that will produce drinking water, drinking quality water. Then we're also going to look at reverse osmosis --

NIOU: You can sell bottled water, though.

LOSI: The same as ion exchange. That's what they want. That's what they want coming out of this thing, is bottled water.

But then we're also going to look at several -- you know, we're going to look at this in depth a little bit because there's also a waste stream from RO, which is typically a little bit more in volume than ion exchange, but it's also a little bit less costly. So there's other ways of treating it. So we're going to look at RO'ing the RO reject stream, further concentrating it. We're also going to look at passing the RO rejectate to a bioreactor and see if we can get reduction of perchlorate that way, which is, you know, another way to treat that waste stream.

And then we're also conducting another study with Dr. William Frankenberg at the University California Riverside to look at a system that he

has. It's a packed-bed reactor system that would be, you know, potentially used with the idea of maybe an on-site source reduction type application, lower flow rates. But the packed-bed reactors are pretty easy to operate, pretty cheap to operate, you know. So as Chuck mentioned, you know, economics is a big part of this thing, along with, you know, process performance.

And so, you know, we're trying to look at some different options and get some preliminary data, at least, so we can make some early calculations, maybe, you know, get some preliminary design data and also some preliminary cost data as well.

BURIL: You can see why --

CUTLER: We'll have something --

LOSI: Yes. Because, you know, ion exchange looks pretty good. It definitely removes perchlorate, you know. And if you go to these meetings, there's various opinions, you know, as to how effective different parts of the process are, you know. So as Chuck mentioned, it's not to put all the eggs in one basket, have some other options as well, have some pretty good information.

RIPPERDA: I don't see any reason to be jumping

the gun. Your draft final FS is in November. You're never going to negotiate everything up through the city anyway so --

BURIL: Oh, no.

RIPPERDA: -- you might as well just follow your schedule. You'll have the FS done in November. It kind of would be time to evaluate your other possible technologies. So the two-month delay that we just added to the FS, you might kind of want it anyway just to tie up the loose ends on some of the other perchlorate issues.

BURIL: Sure. Okay. Well, it sounds to me, then, perhaps we can tell Brad that it's premature. Not no, but later. Okay.

RIPPERDA: He should certainly -- he should be briefing his management on it, because by the time he gets through his management chain you'll have your draft FS done.

ROBLES: We'll probably have our FS issued before the City Council could even make a determination whether they want to even look at this proposal.

RIPPERDA: So what I would tell him is we're highly interested, but get back to me with a more concrete proposal, and then leave it in his lap.

ROBLES: That makes sense. Because I've worked with the cities of Lancaster and Palmdale. If they're anything like Pasadena, it's slower than a snail's pace.

RIPPERDA: Just like any FS, on a very broad gross level, have you looked at mass balance or mass quantities of perchlorate that would have to be like in and around your hot spot to produce the kind of levels you're talking about? Like what if --

CUTLER: No.

RIPPERDA: -- you're producing around 1,000 parts per billion out of a hot spot well, how does that amount of pounds of perchlorate compare to the total picture?

CUTLER: And that's a very good question. We haven't actually done any of those calculations. But that's a very good question because perchlorate, unlike organics, gets flushed pretty easily and you may not have these long-term multiple flushes to get rid of it because it's so mobile. It doesn't absorb anything. As Mark and Vitthal, we have a lot of discussions about this. We haven't done those calculations, but it is a very important part. How much do you want to gear up for perchlorate when it's not quite the VOC problem?

BURIL: I'll share with you, as an example of that, that the influent concentrations to the Calgon program started off in the mid 100s to 200. By the end of the program it was down to about 60.

CUTLER: Right. So how much -- do you want to set up something that could handle all four wells? Your only problem well, I guess, Well 52, is shutting down. Do you just want to deal with where the problem is? Because they've been remediating it with blending since they discovered the problem. There's a lot of other options.

BURIL: 52 has been slowly climbing. Some months ago it was in the low to mid 20s. Then about two months ago it was up into the low 40s. Now, based on my conversation with Brad last week, it's in the low 50s. So they're moving the plume southward by pumping that well. There's no doubt about that.

RIPPERDA: I guess my guess is that I don't doubt that you're going to need some kind of treatment in the Arroyo. But like in the FS, you know, what I'm going to be really interested in is how much is it going to cost per pound of perchlorate. It's like once you start pump -- if you pump at a hot spot, how long are you going to be

getting high levels of perchlorate out of that and is it worth a hot spot removal.

CUTLER: You know, that brings up another big question we've had, is EPA any closer on the tox studies?

RIPPERDA: They're out for public comment right now. They're out for peer review. So there's a preliminary slope factor, you know, risk factor, which you can kind of calculate out to a number, but -- so it's out for public peer review.

LOSI: Do you know what the number is? Do you have any idea?

BURIL: 32 parts per billion.

LOSI: 32?

NIOU: Yeah.

BURIL: So an awful lot of the problem goes away, so to speak.

CUTLER: Exactly. Going down to 32 is a lot easier than going down to 4 or --

BURIL: But remember this, you still have the State to deal with.

RIPPERDA: I was just going to say, once the State's issued a preliminary number it's going to stay.

BURIL: That old phenomenon of regulatory

inertia. Once it's been set it doesn't go up very easily. But, in fact, if it ever goes up, it would be a surprise. It's more likely to go down.

RIPPERDA: Especially since the EPA, U.S. EPA tox numbers indicate 30. 18 is close enough to 30 that you're just going to see 18 stay. If EPA's preliminary numbers were at 2,000, you might see some pressure on California to raise it. But -- and that's EPA's preliminary number.

BURIL: That's not to say that California wouldn't take the same study and apply different uncertainty factors to the determination. If they changed one of them by a factor of 3, you're going to see it down at 10.

RIPPERDA: Right.

BURIL: That's very easily done because they've only -- they've got four uncertainty factors that can range from 1 to 10. Right now they're all set at 3. When you multiply them all together, basically, that's 3 to the fourth power, you get a factor of 100. If they raise each one of those by just up to 5, suddenly that, then, is way down.

CUTLER: Exponential. Does anybody know when the State will conclude their studies?

BURIL: The State is moving forward as we speak

independent of NCEA, National Center for Environmental Assessment, which is an EPA arm that's doing the tox study. So California is moving ahead. And it's a little scary, because they're not waiting for the data that the fed EPA says is necessary to generate what they call good science.

CARLOS: This is DHS or OHEA?

BURIL: This is OHEA.

CUTLER: That's a critical number. It's not going to move. It's not a big deal, but that's critical to what we're doing here.

RIPPERDA: Yeah.

CUTLER: Perhaps we're getting a little ahead. But it doesn't appear it's going to change.

BURIL: Our FS could very easily change at the time of submission because the number has changed.

RIPPERDA: Yeah.

BURIL: I mean, that's something to be keeping in the back of our minds. We're going to proceed as though nothing is changing, of course.

RIPPERDA: Absolutely. Even up to the ROD, if the number changes at the last minute, you can say you're in compliance, just like -- the ROD will reflect whatever is current.

ROBLES: It can be amended later.

RIPPERDA: Yes. It can be amended after the ROD is out. So just totally work as if 18 is going to be there forever.

BURIL: Yes. That's what our charge to Foster Wheeler has been. In fact, our charge to Calgon, and maybe not completely stated to Foster Wheeler, is that 18 parts per billion is not good enough. We want nondetect. If you're going to treat it, we want it down to nothing.

NIOU: Mark, if the level after the ROD sign, if the level change, can the ESP be used?

RIPPERDA: Yes.

NIOU: Oh, okay. Sometimes I thought you have to use it.

RIPPERDA: It would probably be an amendment. Because if you're going to like shut an entire plant off, it's probably going to be big enough you need an amendment.

ROBLES: If it goes up, it's not an easy issue. If it goes down --

BURIL: If it goes up, the issue becomes one of political and logistics ramifications more than technical. If it goes down, you get technical thrown in on top of the political and logistical issues.

ROBLES: But usually when it goes up -- where I've worked at other sites, you've designed, you've planned for the system, just continue as you're going, because it's always the best. But if it goes down, it throws everything out of scale and you've got to go back to the drawing board.

BURIL: That's everything I have on the perchlorate. Anybody have any questions? Okay.

Under "Other."

First of all, what time is it? 11:30. Why don't we press on because I think we probably will be done by the time we want to break for lunch.

Under "Other," did all of you receive the ARARs developments from me?

RIPPERDA: Yeah.

BURIL: Have you had a chance to review that at all?

RIPPERDA: I've looked at it, but I haven't given it to my lawyers to look at.

BURIL: Okay. The "L" word. That and liability.

Okay. So you're still in the process of reviewing it.

RIPPERDA: Yes. So it looks pretty complete to me. The one comment I would have on all of this is

that MCLs in the aquifer are an ARAR, and that's not mentioned anywhere in here. You're talking about kind of a point of discharge. But Superfund, the NCP, says that it's throughout the aquifer.

BURIL: Okay. So your distinction being that we can't only look at point of discharge for the consideration of an MCL as an ARAR. We have to look to the concentrations that are physically present in the aquifer that is supplying water to the point of discharge. Is that right?

RIPPERDA: Right. Any remedies must receive MCLs within the aquifer in a reasonable time frame. And you can kind of -- you've raised this question a long time ago. There's not a hard and fast answer. It's -- some people might argue it's any single monitoring point within the aquifer.

Somebody else might argue, well, it's once you start to produce it at some kind of producible level, 100 gallons a minute or something. And that's somewhat open. But -- so if you're consistently seeing it above MCLs at a monitoring well, that would --

BURIL: That would still drive a remedial action.

ROBLES: Right.

BURIL: That's understood.

ROBLES: Good point.

BURIL: Anything else on this area, at least preliminarily?

ROBLES: Did you see any conflicts?

RIPPERDA: Any conflicts like between the fed's and the State requirements?

ROBLES: Yes.

RIPPERDA: No, because you just go with whatever is more --

ROBLES: Stringent, conservative.

RIPPERDA: You got Porter-Cologne and like that, and you might see something more --

ROBLES: Well, Porter-Cologne does, because basically that's a resource, State resource and basically the issue is there is no ambiguity. The whole resource has to be cleaned up. Now, the question is MCLs, or what?

RIPPERDA: Right. That's --

ROBLES: That's a State issue.

RIPPERDA: That's the -- I'm going to leave between you and the State. EPA has got involved in those arguments before and it said the State's too stringent. So that's kind of our opinion.

ROBLES: So you have MCLs, but the State says

the whole resource has to be cleaned up. It's not --

CUTLER: Nondegradation.

ROBLES: -- nondegradation to drinking water standards. Not MCLs.

RIPPERDA: Right. I understand that. Our lawyers have written various position papers saying why, legally, we don't think that's necessary. But that's still between you and the State. So we're not going to -- EPA is not going to try to be involved in that.

ROBLES: Because, you see, it has an economic impact on the final solution. That's the biggest issue. And that really drives it, you know. Sometimes I've been at sites where, because of that, if it was MCL, we could treat the whole thing. If it's drinking water, then we start dealing with point source and it's like apples and oranges. You're not looking at the whole --

RIPPERDA: Yeah. How do you guys in your offices implement the nondegradation policy?

GEBERT: That's more of a Water Board issue than it is a DTSC issue. We usually defer to the Board on those types of things.

CARLOS: I would have to get back -- I mean

right now I'm still in the process of reviewing that ARAR document.

ROBLES: Alex, could you just kind of keep that in the back of your mind to maybe get that?

CARLOS: Yeah.

ROBLES: Because, see, we are going to need to have this discussion in detail in the future, in the near future. The issue of how we deal with the cleanup is totally tied into the nondegradation issue of Porter-Cologne. More importantly is, do we look at that as a resource totally, or do we look at it as a point source. And that has an implication on how we're going to focus on the remediation. Because sometimes, because of the Porter-Cologne, we can't deal with what's best for the whole aquifer. We got to get that point source because of the nondegradation. And drinking water standards can be very difficult. So therefore, there's an economics and a regulatory ARAR issue that impacts. If it was just MCLs, I think it may be easier. We could deal with the whole strata and everything else.

CARLOS: My initial reaction to that is I think it's the entire aquifer, but I would have to clarify that.

ROBLES: But usually, what I'm saying, Alex, is

that in the sites that I've worked in California, using the EPA definition allows us to attack the whole aquifer. But because of the nondegradation we have to not focus on point of source to mitigate the whole aquifer, and therefore the emphasis is not to the treatment on a systematic approach. The emphasis is where the source is, get to the sources first. So that's a different way of dealing with the cleanup, and therefore it comes to economics and usually yours is, you know, much more expensive. But if that's what you want, that's okay. That's the key issue.

The other implication is that we have the purveyors of water out there. And the purveyors of water are looking at the EPA model more than they're looking at the Water Board. They want the whole resource to be protected and they would like to see MCLs. Ultimately they would really like to see drinking water, but that's almost an impossibility. So we have this dichotomy of different players who have different focuses on seeing the same problem and it's going to create another impact in the process for our contractors to figure out in the feasibility study. It's above and beyond what the normal process is. It's just inherent to

California.

CUTLER: It would be nice to get your guys' reaction on these ARARs so we would have a -- complete our list soon.

RIPPERDA: The list itself seems pretty complete. There may be little things here and there. But I don't -- I can't actually think of one. But it's more the policy. Like how do you -- looking at the list, you know, Safe Drinking Water Act or list the Porter-Cologne Act.

But you might want to propose a policy type statement that you get a response from us, like do you want to remediate the entire aquifer to nondetect, or do you want to protect the wellheads and do we agree with that in terms of our --

CUTLER: That's a huge question.

ROBLES: And we have to articulate those questions. We're going to start needing to articulate. This is the problem with ARARs. Everybody else likes to throw in regulations. We have to glean from that and articulate questions to present to the regulators so they can go back to their lawyers and technical representatives to say, "Okay, we come to a meeting of the minds. This is the playing field."

CUTLER: I think the place to start is just a list to start with.

BURIL: Right. I think the thing, too, that we've got to recognize is that when we start talking about big policy questions like you just posed, Mark, is it the aquifer or is it protecting the wellhead, that the implications to the feasibility study become very, very powerful.

RIPPERDA: Right. That's why I want to start formulating those questions as soon as I --

BURIL: Now.

RIPPERDA: It's one thing to have a list. That's great. But by the next meeting you're going to -- the feasibility study is going to propose a list of remedies and each of those remedies has to be compared to ARARs. If one potential remedy is you treat at the wellhead and do a natural attenuation, it happened in the rest of the reservoir, well, then you -- let's forget natural attenuation. You're going to treat at the wellhead, does that meet ARARs or not? Then you have to like --

BURIL: At that point you have to have some way of knowing.

RIPPERDA: You can't just say it doesn't comply

with Porter-Cologne, you have to give your analysis of why or why doesn't it comply with Porter-Cologne.

BURIL: Right.

ROBLES: Nondegradation.

BURIL: Or that's your interpretation of the ARAR.

GEBERT: That's the key to me, is what it says. It's one thing to list them. I think you did a very good job of listing all the possible ARARs. But the devil is in the interpretation.

ROBLES: Devil in the details.

GEBERT: That's what we have to all get together and say yes --

BURIL: This will be interpreted in this particular fashion for this particular site.

GEBERT: Interpret it to mean this, and therefore in our feasibility study you can tell it's this.

BURIL: Yeah.

ROBLES: Are you looking at it from the standpoint of feasibility study - this is for Mark's benefit - that it's not only just the economics and the ability to meet the remedial goals and so on, or MCLs or drinking water, but what you're looking at is how many of these regulations does it comply

with. The more it complies with, the better it looks to you.

Because then you're basically to the public that said this technology does meet ARARs, whereas if it meets one but not the other one, we have to kind of use the words to be able to say, "Well, it doesn't, but it does, and we're meeting the goals." Then we have to justify why it does that. Porter-Cologne is a classic one. So we're looking at more how many regulations it meets, how many regulations does it comply with. Because it's easy for you to sell that.

RIPPERDA: So I guess by the next couple -- the next, maybe, couple months I'd want to see just some rough proposals of like the major options. One is do nothing, leave wells shut in, mix.

Next would be wellhead treatment at the Arroyo Seco wells, possible Lincoln Avenue, any downgradient-affected wells, you know.

Next would be that downgradient treatment plus some on-site source removal.

CUTLER: These are all on the list.

RIPPERDA: Great. Have that list, and then compare them to the major policy ARARs. Don't talk about details of the specific treatment technology

and discharge or air emissions, but talk about how it complies with like things that have some kind of -- where people can interpret them differently.

ROBLES: Which means you're going to give them to your regulatory interpreters to be able to glean out policy statements out of the ARARs.

CUTLER: Right. We still would like as a starting place just to -- a list. Maybe we're missing one that is a bigger role than -- maybe there's some on there that you don't think should be on there. We don't need to spend the time.

CARLOS: Right down the list, going through it very quickly, looks complete right now. We'll let you know if we'd like to see additional items or some items that we don't think would be necessary.

BURIL: In that same vein, this morning at 9:00 o'clock we got a letter here from Ron Palmer at Raymond Basin Management Board. He was quite concerned that they were not notified, supposedly, of this meeting taking place.

Let me pass out the letter to you, because he asks that we distribute this letter to all you folks so that you know what's happened.

I have to say that, unfortunately, I think that Ron kind of shot from the hip on this one

because he is misinterpreting the facts.

First of all, he asks that we have a special meeting to discuss this exact issue, the ARARs, and that it be developed with Mark and the other agencies and sat down with him. It doesn't sound like we're ready to do that. Probably at our next regular meeting we'll be a lot closer to it.

Just to give you some background on this, the back sheet of this is a note from my secretary. Basically, she went back to her records and found that actually she had contacted Rich Atwater's office on February 4th, left him a message to basically inform him of this meeting today. Additionally, they call out the March 2nd letter. My recollection says that we either sent Rich a copy of the ARARs or cc'd him through one of you folks. I'm not sure exactly how we did it. But they received a copy of this letter, and in the letter it states the next meeting is March 25th.

And the 24-hour notice that he's indicating was our contacting them yesterday to let them know that the meeting time had changed from 10:00 to 9:00.

I don't know how you folks feel about special meetings, but it seems to me that our next

regular meeting should be sufficient to address this concern.

I personally am in a position of writing a letter back to Mr. Atwater or Mr. Palmer and saying "You're wrong. You were notified, but apparently you forgot."

So this is just to keep you folks informed and also to see if you did have a collective concern with regard to a special meeting if you did think that was a good idea or not or --

ROBLES: Emphasize in the letter the next meeting we're discussing ARARs.

BURIL: We will discuss ARARs.

ROBLES: And that will be the appropriate time for him to come.

RIPPERDA: I hate the "you're wrong" letter. I know you're much nicer than that.

BURIL: Yes.

ROBLES: Misunderstood.

RIPPERDA: You apologize for a misunderstanding, and this meeting mostly discussed the groundwater model and we're going to discuss treatment technologies at the next meeting and we'd like to have you come. I'm sorry that we buried the information on a letter with other stuff, or

something like that.

ROBLES: An obscure page.

BURIL: An obscure page of two paragraphs.

RIPPERDA: Yeah.

BURIL: Okay. We'll do that. But then the next meeting, that will be right.

RIPPERDA: I don't really want to go to a special meeting.

BURIL: I don't see the need for it and I don't think you folks are ready. I don't think we're ready.

ROBLES: The bottom line is, I will let you know, that Raymond Basin is very much concerned in using the ARAR issues to make sure that they get the whole Raymond Basin cleaned up. They don't care who does it. So understand that's one of their major goals in arguing the ARAR issue.

RIPPERDA: That's why it's really -- I know you did your part to get them here, but it is really important to have them here --

ROBLES: Yes.

BURIL: We agree.

ROBLES: Oh, yes. We agree.

RIPPERDA: -- to present that sounding board.

ROBLES: Sure. That sounding board, sure.

BURIL: Because anything that we do here is going to ultimately require their buy-in because they are the, quote-unquote, keepers of the adjudication.

ROBLES: They are a major player and we don't want to keep them out.

BURIL: I just wanted to be sure you folks were aware of that. It doesn't sound like a special meeting is necessary. So we'll fire back a letter to them saying, "Gee, sorry for the misunderstanding and, by the way, this is the next meeting."

RIPPERDA: You can certainly attach this.

BURIL: Oh, we will. We will.

I think that's just about all of it on the docket for this particular point in time.

Mark, was there anything else that you had?

CUTLER: One minor. The NDMA and dioxane.

BURIL: Yes. I forgot about that. Go ahead.

CUTLER: We had, about a year ago, agreed to sample six wells for NDMA and 1,4-dioxane, sample it twice. As a screening, we went to the most contaminated wells and the screening to see if it was there. Well, as of this last event we finished our fourth sampling. So we've done more than we

originally had planned on.

The last three events, we don't have the data from this last quarter, but the previous three events NDMA has been nondetect at all, with a detection limit of 5 nanograms per liter. We would like, if we get ND this time, can we stop sampling for it?

And the other question is 1,4-dioxane. We have three sets of results. We detected it twice in Well 16 right near the detection limit at 5 parts per billion and 3.7 parts per billion. There is no MCL, but EPA lifetime cancer has it at 7 micrograms per liter. The EPA IRIS number is 10 to the minus 6 is also 7 micrograms per liter. So if we get -- I'd like to ask for this last round, if we get ND or similar results less than 7, can we also stop sampling for 1,4-dioxane?

BURIL: Basically, it's discontinue the analysis for NDMA and 1,4-dioxane contingent on the results that are coming from this last quarter of sampling we just completed.

CUTLER: Right.

BURIL: Maybe that should be part of the proposal that we put out to them as far as formal changes.

RIPPERDA: So your dioxane is coming in really close to the -- not an MCL, but to a health-based number.

CUTLER: It's below. Right. The health-based number is 7.

RIPPERDA: You're coming in at 2, 3, 4, 5.

CUTLER: We hit it 3.7 and a 5.

BURIL: With several detections in between nondetect.

CUTLER: Then we had a nondetect. It was 5, nondetect, 3.7. And we don't know this last one. That was only at one well. So it does not appear that this is a problem at this site. There's not a --

BURIL: It's not a widespread problem. It's only been found in one well.

CARLOS: Only in one well?

CUTLER: Only in one well.

RIPPERDA: You can monitor that nearby well, downgradient wells, you have nondetects.

CUTLER: That's what these are. Well 16, Well 7, Well -- it was detected in Well 16. Immediately downgradient from 16 is 13 and 7. And both of those wells and Well 4, screen 2 farther downgradient from them and all those have been

sampled all at the same time. Those have all been nondetect.

GEBERT: So you only have (unintelligible) upgradient wells (unintelligible) the detects for the 1.4.

CUTLER: Right. The purpose of this screening of these six wells was to see if we had an issue --

BURIL: Mark, here is 16. Here is 13. What was the other one you mentioned?

CUTLER: 7.

BURIL: 7 is up here.

CUTLER: And Well 4, screen 2 is where the plume is getting deeper off site. We also have -- and then 24, 1, right in the middle there, Chuck. Well 24. Right there.

All of those have been sampled. So as far as the screening purposes, it does not appear there's a 1,4-dioxane problem. Of course, NDMA nondetect at all times.

GEBERT: For me, I don't have a problem. If the next round is ND in the --

BURIL: We'll put it in that same proposal for the changes to the monitoring program, then. We'll then have the data when we go to do that proposal. And if it's ND, we'll lay it in there as part of the

proposal.

CUTLER: Could we --

RIPPERDA: My feeling is if something is consistently nondetect, you just drop it. If something's near a health-based level but it's not widespread, it's very localized, I might want to see that like sampled for once a year at the affected well and a couple downgradient wells.

BURIL: Kind of the same philosophy as the lead and arsenic?

RIPPERDA: Yeah. Because if it's near a health-based number and it's there, so maybe just once a year over, you know, five years or so. I don't know how long -- how many sampling events you did, like how far back in time you go with it.

CUTLER: This will be a year. This last one will be a one-year sampling for these.

BURIL: Okay. Anything else? Anything from the regulatory side?

Okay. We're adjourned.

CARLOS: When is our next meeting?

GEBERT: Next meeting.

BURIL: Next meeting. First of all, any comments on the last meeting minutes?

GEBERT: No.

BURIL: Stand approved as is?

Okay.

Did we have any action items that we need to review quickly? No. From this one.

NOVELLY: From this one the only one we have is that we're going to be sending out a letter proposing the changes to the annual report.

BURIL: We didn't bring the minutes from the last meeting to check action items, but I don't think we had many.

My mistake. Let's see.

Two action items was what came out of the last one. We were going to e-mail Dan Stralka the information on the speciation of chrome. I think that was sent out to him, because he has mentioned that.

CUTLER: As far as I know, there has been no issues brought up. I talked to him since then.

BURIL: So we can call that one closed.

The second one was we're going to check the FFA and the guidance to see where we're going to put the QA/QC section.

Anybody remember that?

RIPPERDA: I think those are my comments. And I don't remember.

BURIL: I'll ask you to try to go back and refresh your memory.

RIPPERDA: Okay.

BURIL: We'll do the same by going through the notes and we'll see if we can call that one closed at the next meeting. Okay.

All right, then. Next meeting. Probably we want to not stretch it out too far, given the time frame of the FS and so forth. What kind of time frames do you fellows think you'll need to complete your reviews of the ARAR list that we've given you?

ROBLES: Does June seem to be too far away?

CARLOS: For the ARARs?

CUTLER: That's when the FS is due.

ROBLES: So you want something before?

BURIL: It would be helpful, yes.

CUTLER: We have to get together either on the phone --

ROBLES: May.

BURIL: We may want to talk about phone conferences. We do have a standing conference time, of course the first Thursday of each month, as I recall. We haven't been following that rigidly, but we may want to just re-implement that. And there

may be another opportunity here to think about meeting face to face in a shorter time frame than the three months that the FFA calls for, because in three months we're going to be submitting to you the FS.

ROBLES: I think we do need a meeting.

BURIL: I think we do, too, actually. I would say --

GEBERT: May sounds --

BURIL: -- May sounds about right. So maybe beginning the middle of May. Did anyone bring a calendar?

CARLOS: Most of May I'll be out. But I can have maybe Jon Bishop attend.

BURIL: Oh, yeah. Jon's familiar with the site. That would be fine.

First full week in May starts on the 3rd.

RIPPERDA: When are you gone?

BURIL: When are you gone, Alex?

CARLOS: May 6th.

BURIL: Starting May 6th?

CARLOS: I'll be back, though, on June 1.

ROBLES: Why don't we shoot for May 4th.

BURIL: May 4th is a Tuesday, first Tuesday of the month. Does anybody have any problem with that?

ROBLES: That will allow us to get everybody in. And it's early enough in the morning.

BURIL: That still gives us close to 30 days to be able to respond to anything that comes out of that, so hopefully that should be good.

Okay. May 4th it is.

RIPPERDA: Can we shoot comments back to you on your ARAR list sooner than that?

BURIL: It would be helpful to us to have them back at least two weeks sooner than that. So if we could get them, say, the week of April 19th, that would be ideal. That gives you folks about 30 days to get them together. A little less than that. Three weeks.

CARLOS: Time would be?

BURIL: Time would be 10:00 a.m., in deference to Mark flying down that day.

RIPPERDA: Yes. 10:00 a.m. is good.

BURIL: Here, same place, same channel, so to speak? Okay.

RIPPERDA: Can Stephen get a copy of this ARAR packet when he also gets the OU-2 RI?

NOVELLY: Sure.

BURIL: Come on down with us. We'll give it to you up there.

All right. We stand adjourned.

Thank you all.

(The proceedings adjourned at 11:53 A.M.)